REMARKS

Reconsideration of the above-identified patent application in view of the remarks following is respectfully requested.

Claims 1-35 are in this case. Claims 1-6, 8, 10-15 and 17-35 have been rejected. Claims 7, 9, 16 and 18 have been objected to. Originally numbered claims 1-34 have been renumbered 1-35 in accordance with the Examiner's remark in the objections. The following refers to claim numbers as used by the Examiner (i.e. the renumbered claims).

The Applicant has slightly amended the language of independent claims 1 and 11 and dependent claims 3 and 12, by adding the words "isolated resonant" before "local defect", to more clearly point out and differentiate the invention from prior art. Support for the amended language may be found throughout the specification, for example in page 2, paragraph starting on line 16 and in the description of FIG. 10 starting on p. 18, line 30. The Applicant has amended claims 6, 7, 15 and 16 to correct mistaken words and to remove unnecessary limitations, and claims 8 and 17 to correct the grammar. Claims 7, 12-18, 20-24, 26-31 and 33-35 were also amended to indicate dependency from renumbered claims.

The applicant has found two minor errors in the specification involving non-essential language. These errors have been amended as shown.

§ 102(b) Rejections

The Examiner has rejected claims 1-6, 8, 10, 11, 13-15, 17, and 19-35 as being anticipated by US Patent Publication No. 2002/0146196 to Shirane et al. The Examiner's rejection is respectfully traversed.

The Examiner states that regarding claims 1-3, 10, 11, 19, 20, 23, 25-27 and 32-32, Shirane discloses a dynamically controllable photonic crystal comprising "at least one *local defect* (line-defect waveguide formed by "missing rods"; see paragraph 0048, figures 3b, 6, 7, 12), the line-defect waveguide *acting as a micro-cavity (paragraphs 0057, 0058)*" In view of the amended language of independent claims 1

and 11, the Applicant respectfully submits that the "line-defect waveguide" in Shirane's application is not an isolated resonant local defect in any recognized sense of the word, and is certainly not "acting" as a micro-cavity. His line-defect waveguide is neither an "isolated local" defect nor resonant, but an extended, non-resonant defect, involving a line of "isolated local" defects (e.g. air or second dielectric holes). The generally accepted meaning of the term "micro-cavity" (interchangeable in the present invention with "local defect", see p. 1 line 33) refers to "*any deviation from a periodicity that can enable or support a localized mode (in the vicinity of the micro-cavity)*". "Micro-cavity" and "resonance" are uniquely linked, as well known in the art. Furthermore, the terms "isolated resonant local defect" as recited in the amended independent claims 1 and 11, or "micro-cavity" as recited in claims 19, 25 and 32, clearly refer (as indicated in the present specification) to a local isolated dielectric resonator that can be regarded as a local high-Q cavity with a resonant frequency w_0, which can be finely tuned (shifted) by a local dielectric material variation induced by carrier refraction. The fine-tuning capability is an inherent property of an isolated resonant local defect or micro-cavity of the present invention. The isolated resonant local defect or micro-cavity and its fine-tuning capability are key features in every device of the present invention, for example the devices recited in claim 24.

In contrast, a line-defect waveguide as in Shirane has no resonant properties, and therefore cannot provide resonance fine-tuning capabilities and cannot enable devices based on such capabilities. The words "micro-cavity" or "resonant" do not appear even once in Shirane's application, for good reason: his structure has nothing in common with, and none of the properties of, a photonic crystal micro-cavity. Since Shirane's photonic crystal does not include a "micro-cavity", Shirane's electrical injection of carriers or application of reverse bias does not affect a resonance property, but involves a change in the energy band (paragraphs 0059, 0071, 0072), which opens or closes the path for light in the waveguide, and therefore provides two states of "ON" and "OFF". As stated by Shirane for his first two embodiments: "when current is injected or a reverse bias voltage is applied between the electrodes 80 and 81, the photonic band structure of the photonic crystal around the line-defect optical waveguide changes, by which the propagation mode of the line-defect waveguide becomes to be outside the photonic band-gap, whereby light can no longer propagate

through the line-defect waveguide (paragraph 0072). Alternatively, the propagation mode of the line-defect that exists outside the photonic band gap in the first place may become to be within the photonic band gap due to current or voltage application, allowing light to propagate therethrough" (paragraph 0073). The other four embodiments in Shirane's application refer to light (not electrical) carrier injection, and are therefore irrelevant to the present invention. Moreover, the basic physical principle they operate on is the same as in his first two embodiments.

Shirane's invention is based on carrier effects on "energy bands", which are nothing but dispersion curves. It is well known in the art that a dispersion curve in a periodic structure and a resonance of a small (micro) cavity represent two completely different and totally unrelated physical phenomena. Knowledge of effects of injected carriers on dispersion properties cannot in any way be used to anticipate the devices based on resonance effects of the present invention, as recited in the claims.

In summary, in view of the arguments presented above, it is respectfully submitted that a device based on Shirane's photonic crystal does not comprise a structure having a periodic variation in dielectric constant, the structure including a substrate characterized by a substrate refractive index, the structure further including at least one isolated resonant local defect, as recited in amended claim 1. Further, a device based on Shirane's photonic crystal does not comprise a silicon substrate with a periodic array of air rods disposed therewithin, the silicon substrate further including at least one isolated resonant local defect, as recited in amended claim 11. Further yet, a device based on Shirane's photonic crystal does not comprise at least one micro-cavity configured to dynamically manipulate an optical beam and electrical means to facilitate the manipulation (by the micro-cavity, of the optical beam), as recited in claim 19. Furthermore, the method of operation of Shirane's photonic crystal does not comprise providing a photonic crystal having a substrate characterized by a substrate index of refraction, the photonic crystal further having at least one micro-cavity, the electromagnetic wave motion interacting with the at least one micro-cavity; and electrically affecting a parameter of the at least one micro-cavity, thereby affecting the electromagnetic wave motion through the photonic crystal, as recited in claim 25. Finally, the method of operation of Shirane's photonic crystal does not comprise forming in a photonic crystal substrate at least one micro-cavity that resonates at a

given frequency, and inducing a slight dielectric constant alteration of the substrate in the vicinity of the at least one micro-cavity to obtain a fine resonance tuning of the frequency, as recited in claim 32.

Regarding the Examiner's rejection of claims 4, 5, 13, 14, 21, 22, 28, 29 and 35, based on Shirane's disclosure of means to inject or deplete charge carriers from the semiconductor substrate, the Applicant submits that all these claims depend from main claims that have been erroneously rejected, as argued above. In particular, Shirane's disclosure lacks the key inventive feature of the present invention, i.e. an isolated resonant local defect or micro-cavity and its resonance fine-tuning capability, as recited in the independent claims. Therefore, the application of his injection means to devices that operate on the principle of dispersion changes under an electrical field does not anticipate the present invention as recited in the claims.

Regarding the Examiner's rejection of claims 6, 8, 15 and 17, the Applicant submits that all these claims depend from main claims that have been erroneously rejected, as argued above.

Regarding the Examiner's rejection of claim 24, the Applicant submits that this claim depends indirectly from independent claim 19 that has been erroneously rejected, as argued above.

Regarding claims 30 and 31, the Applicant submits that these claims depend indirectly from independent claim 25 that has been erroneously rejected, as argued above.

The Applicant thus respectfully submits that Shirane's invention is irrelevant to, and most certainly does not anticipate the present invention as recited in claims 1-35.

§ 103(a) Rejections

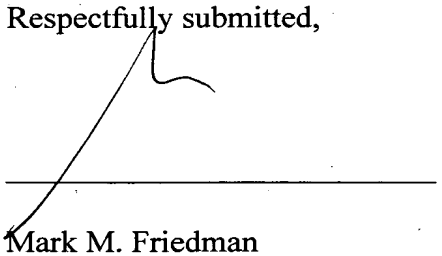
The Examiner has rejected claim 12 as being unpatentable over Shirane et al. in view of an article by Joannopoulos et al, cited by applicant. The Examiner's rejection is respectfully traversed. Claim 12 is directed to a dynamically controllable silicon photonic crystal comprising a silicon substrate with a periodic array of air rods disposed therewithin, the silicon substrate further including at least one isolated resonant local defect, wherein the air rods are circular, with a diameter larger than that of the at least one local defect; and means to induce electrically a local carrier refraction change in the vicinity of the at least one isolated resonant local defect, thereby affecting dynamically an electromagnetic wave propagating through the photonic crystal. As mentioned, Shirane's invention discloses devices that operate on the principle of dispersion changes under an electrical field, and not resonant changes occurring in a single isolated micro-cavity. Joannopoulos's suggestion to modify Shirane by including defects with a smaller radius than the air rods will only lead to an extended line-defect waveguide with changed dispersion properties. This change is irrelevant to the present invention, in which the principle of operation of all the devices is based on the fine-tuning capability of a single, isolated resonant local defect.

Allowable Subject Matter

The Examiner has allowed claims 7, 9, 16 and 18 if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The applicant gratefully acknowledges this conditional allowance. However, in view of the arguments above, the Applicant submits that this subject is now moot.

In view of the above amendments and remarks, it is respectfully submitted that claims 1-35 are in condition for allowance. Prompt notice of allowance is respectfully and earnestly solicited.

Respectfully submitted,



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